

Accepted Manuscript

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PII: S0304-3894(16)30868-8
DOI: <http://dx.doi.org/doi:10.1016/j.jhazmat.2016.09.046>
Reference: HAZMAT 18052

To appear in: *Journal of Hazardous Materials*

Received date: 13-4-2016
Revised date: 20-9-2016
Accepted date: 21-9-2016

Please cite this article as: Ivan Mikhailov, Sergey Komarov, Vera Levina, Alexander Gusev, Jean-Paul Issi, Denis Kuznetsov, Nanosized zero-valent iron as Fenton-like reagent for ultrasonic-assisted leaching of zinc from blast furnace sludge, *Journal of Hazardous Materials* <http://dx.doi.org/10.1016/j.jhazmat.2016.09.046>

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Nanosized zero-valent iron as Fenton-like reagent for ultrasonic-assisted leaching of zinc from blast furnace sludge

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Highlights

- nZVI is used as Fenton-like reagent for activation of Zn leaching from the BFS.
- nZVI has positive effect on kinetics of Zn leaching though with some loss of efficiency.
- A complex ultrasonic-assisted method for BFS recycling is proposed.

Abstract:

Ultrasonic-assisted sulphuric acid leaching combined with a Fenton-like process, utilizing nanoscale zero-valent iron (nZVI), was investigated to enhance the leaching of zinc from the blast furnace sludge (BFS). The leaching of iron (Fe) and zinc (Zn) from the sludge was investigated using Milli-Q water/BFS ratio of 10 and varying the concentration of hydrogen peroxide, sulphuric acid, the temperature, the input energy for ultrasound irradiation, and the presence or absence of nZVI as a Fenton reagent. The results showed that with 1 g/l addition of nZVI and 0.05 M of hydrogen peroxide, the kinetic rate of Zn leaching increased with a maximum dissolution degree of 80.2 %, after 5 min treatment. In the absence of nZVI, the maximum dissolution degree of Zn was 99.2 %, after 15 min treatment with 0.1 M of hydrogen peroxide. The rate of Zn leaching at several concentrations of hydrogen peroxide is accelerated in the presence of nZVI although a reduction in efficiency was observed. The loss of Fe was no more than 3%. On the basis of these results, the possible route for BFS recycling has been proposed (BFS slurry mixed with sulphuric acid and hydrogen peroxide is recirculated under ultrasonic irradiation then separated).

Keywords: Nanosized zero-valent iron; Fenton process; Zinc removal; Ultrasonic-assisted leaching; Blast furnace sludge.

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